What is claimed is:

1. A transcoding method of performing conversion between compressed bitstreams having at least syntax elements and video elements corresponding to video data, the transcoding method comprising the steps of:

a) decoding a first bitstream compressed according to a first compression method and parsing syntax elements and video elements;

b) mapping the parsed syntax elements to syntax elements complying with a target second compression method;

c) partially reconstructing video data complying with the first compression method from the parsed video elements;

d) requantizing the video data reconstructed in the step c) according to the second compression method; and

e) coding the mapped syntax elements and the requantized video data to obtain a bitstream complying with the second compression method.

2. The transcoding method of claim 1, wherein the first compression method is a moving picture experts group (MPEG)-1 compression method, the second compression method is a MPEG-4 compression method, and the step b) comprises:

b-1) converting a MPEG-1 f_code into a MPEG-4 f_code;

b-2) converting a MPEG-1 macroblock (MB) type into a MPEG-4 MB type;

b-3) converting a MPEG-1 coded block pattern (CBP) into a MPEG-4 CBP; and

b-4) converting a MPEG-1 MQUANT value (a quantization parameter in MPEG-1) into a MPEG-4 DQUANT value (a difference of quantization parameters).

3. The transcoding method of claim 2, wherein the step b-1) performs the conversion according to the following equation,

$$\begin{aligned}&\text{vop\_f\_code\_forward}\\&=\max((\text{forward\_f\_code}-1),\ 1)\end{aligned}$$

where max(a, b) is an operator of selecting a larger value between "a" and "b".

4. The transcoding method of claim 2, wherein the step b-2) comprises the steps of:

(i) setting "nomc+coded" as a MPEG-4 "inter" type and setting a motion vector to (0, 0);

(ii) setting "nomc+coded+q" as a MPEG-4 "inter+q" type and setting a motion vector to (0, 0);

(iii) setting "mc+not coded" as a MPEG-4 "inter" type, using a motion vector as it is, and setting both "cbpy" and "cbpc" to zero; and

(iv) setting the value of "code" determining "not coded" in MPEG-4 to 0 such as "cod=0" as many times as skipped MBs.

5. The transcoding method of claim 2, wherein the step b-3) comprises the steps of:

b-3-1) individually coding cbpy according to the following equation,

$$cbpy = (cbp\&0x3c) >> 2$$

where "&" indicates an AND operation performed in bit unit, "0x3c" indicates "3c" of a hexadecimal number, and ">>n" indicates an n-bit right shift operation; and

b-3-2) coding cbpc according to the following equation,

$$cbpc = (cbp\&0x03) >> 2,$$

and

the cbpc is united with the MB type obtained in the above step b-2) and coded to comply with an mcbpc VLC table of corresponding MPEG-4 I-VOP and P-VOP.

6. The transcoding method of claim 2, wherein the step b-4) performs the conversion according to the following equation,

$$\begin{aligned} &dquant \\ &\quad = \min\,(\max((\text{mquant of current MB} - \text{mquant of previous MB}),\ -2),\ 2). \end{aligned}$$

7. The transcoding method of claim 2, wherein the step d) comprises the steps of:

estimating a Laplacian distribution of a discrete cosine transform (DCT) coefficient reconstructed from a MPEG-1 bit stream;

determining a reconstruction level using the estimated Laplacian distribution of the DCT coefficient; and

performing quantization according to MPEG-4 using the determined reconstruction level.

8. The transcoding method of claim 2, wherein when an output y with respect to an input DCT coefficient x is expressed by $y = Q_1(x) = \left\lfloor \left\lfloor \frac{x}{\Delta} + \frac{1}{2} \right\rfloor \cdot \Delta \right\rfloor$, a quantization step size Δ_i is given by $\Delta i = \frac{Wi \cdot Q_p}{8}, \ i = 0,1,2\cdots,63$ (Q_p is a quantization parameter), a decision level t_m is given by $t_m = (m - \frac{1}{2}) \cdot \Delta, \quad m \geq 1$, $x_m = \{x | x \in [t_m, t_{m+1}]\}$ when x belongs to a section $[t_m, t_{m+1}]$, an amplitude level λ_m of x_m is expressed by $\lambda_m = \left\lfloor \frac{x_m}{\Delta} + \frac{1}{2} \right\rfloor$, an output x' with respect to the input DCT coefficient y, which has been quantized by a MPEG-1 quantizer having a dead zone in which a reconstruction level for x_m, that is, an inverse-quantized DCT coefficient r_m is given by $r_m = \lfloor \lambda_m \cdot \Delta \rfloor$, is expressed by

$$x' = Q_2(y) = \begin{cases} \left\lfloor \left\lfloor \frac{y}{\Delta'} \right\rfloor \cdot \Delta' + \frac{\Delta'}{2} \right\rfloor & \text{if } Q_p \text{ is odd} \\ \left\lfloor \left\lfloor \frac{y}{\Delta'} \right\rfloor \cdot \Delta' + \frac{\Delta'}{2} \right\rfloor - 1 & \text{if } Q_p \text{ is even} \end{cases}$$

, a quantization step size Δ' is given by $\Delta' = 2Q_p$, a decision level t'_n is given by $t'_n = n \cdot \Delta', \quad n \geq 1$, $y_n = \{y | y \in [t'_n, t'_{n+1}]\}$ when the output y belongs to a section $[t'_n, t'_{n+1}]$, and an amplitude level of y_n, that is, an inverse-quantized DCT coefficient λ'_n is requantized by a MPEG-4 quantizer having a dead zone defined as $\lambda'_n = \left\lfloor \frac{y_n}{\Delta'} \right\rfloor$ and is converted into a MPEG-4 DCT coefficient, the step d) comprises the steps of:

d-1) defining subscript values allowing the decision level to belong to a section $[t_m, t_{m+1}]$ as a set $P = \{p | t'_p \in [t_m, t_{m+1}]\}$;

d-2) defining candidates of the subscript values of the decision level as a set $K = P \bigcup \{\min\{P\} - 1\}$ where the symbol $\bigcup$ indicates a union and an operator min{A} indicates a minimum value among the members of a set A; and

d-3) selecting a member satisfying a cost function from among the candidate subscript values as a final subscript value, the cost function being expressed by

$$k = \arg \min_{k \in K} |C_m - r'_k| \quad where \quad C_m = \frac{\int_{t_m}^{t_m+1} x \cdot p(x)dx}{\int_{t_m}^{t_m+1} p(x)dx}$$

where C_m is an optimum reconstruction level in the section $[t_m, t_{m+1}]$ used by a Lloyd-Max quantizer in view of mean square error, and $p(x)$ is a Laplacian distribution function.

9. The transcoding method of claim 8, wherein in the step d-3), C_m is obtained by analyzing the statistical characteristic of $p(x)$.

10. The transcoding method of claim 9, wherein when it is assumed that AC DCT coefficients comply with a Laplacian distribution expressed by

$$p(x) = \frac{\lambda}{2} \cdot e^{-\lambda|x|},$$

a step of determining the value of λ determining the statistical characteristic of $p(x)$ comprises the steps of:

d-3-1) calculating an average of a random variable $|x|$ according to

$$E(|x|) = \int_{-\infty}^{\infty} |x| \cdot p(x)dx = \int_{-\infty}^{\infty} |x| \cdot \frac{\lambda}{2} \cdot e^{-\lambda|x|}dx = \frac{1}{\lambda}$$; and

d-3-2) determining λ according to $\lambda = \frac{1}{E(|x|)}$.

11. The transcoding method of claim 10, wherein the step d-3-2) comprises the steps of:

d-3-2-1) approximating the value of $E(|x|)$ according to

$$E(|x|) \cong E(|y|) + E(|z|)_{\frac{\Delta}{2}}$$

where $E(|z|)_{\frac{\Delta}{2}} = \int_{-\frac{\Delta}{2}}^{\frac{\Delta}{2}} |z| \cdot p(z)dz$, and $p(z) = \frac{\lambda'}{2} \cdot e^{-\lambda'|z|}$ *where* $\lambda' = \frac{1}{E(|y|)}$;

d-3-2-2) calculating $E(|z|)_{\frac{\Delta}{2}}$ according to

$$E(|z|)_{\frac{\Delta}{2}} = 2 \cdot \int_{0}^{\frac{\lambda}{2}} z \cdot \frac{\lambda'}{2} \cdot e^{-\lambda'/z}dz = \frac{1}{\lambda'} - e^{-\lambda'\Delta/2}\left(\frac{1}{\lambda'} + \frac{\Delta}{2}\right)$$; and

d-3-2-3) estimating the value of λ according to

$$\lambda = \frac{1}{E(|x|)} \cong \frac{1}{E(|y|) + E(|z|)_{\frac{\Delta}{2}}} = \frac{\lambda'}{2 - e^{-\lambda'\Delta/2}\left(1 + \frac{\Delta}{2}\lambda'\right)}.$$

12. A requantizing method in which an output y with respect to an input DCT coefficient x is expressed by $y = Q_1(x) = \left\lfloor \left\lfloor \frac{x}{\Delta} + \frac{1}{2} \right\rfloor \cdot \Delta \right\rfloor$, a quantization step size Δ_i is given by $\Delta i = \frac{Wi \cdot Q_p}{8}, \quad i = 0,1,2 \cdots, 63$ (Q_p is a quantization parameter), a decision level t_m is given by $t_m = (m - \frac{1}{2}) \cdot \Delta, \quad m \geq 1$, $x_m = \{x | x \in [t_m, t_{m+1}]\}$ when x belongs to a section $[t_m, t_{m+1}]$, an amplitude level λ_m of x_m is expressed by $\lambda_m = \left\lfloor \frac{x_m}{\Delta} + \frac{1}{2} \right\rfloor$, an output x' with respect to the input DCT coefficient y, which has been quantized by a MPEG-1 quantizer having a dead zone in which a reconstruction level for x_m, that is, an inverse-quantized DCT coefficient r_m is given by $r_m = \lfloor \lambda_m \cdot \Delta \rfloor$, is expressed by

$$x' = Q_2(y) = \begin{cases} \left\lfloor \left\lfloor \frac{y}{\Delta'} \right\rfloor \cdot \Delta' + \frac{\Delta'}{2} \right\rfloor & \text{if } Q_p \text{ is odd} \\ \left\lfloor \left\lfloor \frac{y}{\Delta'} \right\rfloor \cdot \Delta' + \frac{\Delta'}{2} \right\rfloor - 1 & \text{if } Q_p \text{ is even} \end{cases}$$

, a quantization step size Δ' is given by $\Delta' = 2Q_p$, a decision level t'_n is given by $t'_n = n \cdot \Delta', \quad n \geq 1$, $y_n = \{y | y \in [t'_n, t'_{n+1}]\}$ when the output y belongs to a section $[t'_n, t'_{n+1}]$, and an amplitude level of y_n, that is, an inverse-quantized DCT coefficient λ'_n is requantized by a MPEG-4 quantizer having a dead zone defined as $\lambda'_n = \left\lfloor \frac{y_n}{\Delta'} \right\rfloor$ and is converted into a MPEG-4 DCT coefficient, the requantizing method comprising the steps of:

d-1) defining subscript values allowing the decision level to belong to a section $[t_m, t_{m+1}]$ as a set $P = \{p | t'_p \in [t_m, t_{m+1}]\}$;

d-2) defining candidates of the subscript values of the decision level as a set $K = P \bigcup \{\min\{P\} - 1\}$ where the symbol $\bigcup$ indicates a union and an operator min{A} indicates a minimum value among the members of a set A; and

d-3) selecting a member satisfying a cost function from among the candidate subscript values as a final subscript value, the cost function being expressed by

$$k = \arg \min_{k \in K} |C_m - r'_k| \quad where \quad C_m = \frac{\int_{t_m}^{t_m+1} x \cdot p(x) dx}{\int_{t_m}^{t_m+1} p(x) dx}$$

where C_m is an optimum reconstruction level in the section $[t_m, t_{m+1}]$ used by a Lloyd-Max quantizer in view of mean square error, and $p(x)$ is a Laplacian distribution function.

13. The requantizing method of claim 12, wherein in the step d-3), the balance point C_m is obtained by analyzing the statistical characteristic of $p(x)$.

14. The requantizing method of claim 13, wherein when it is assumed that AC DCT coefficients comply with a Laplacian distribution expressed by

$$p(x) = \frac{\lambda}{2} \cdot e^{-\lambda|x|},$$

a step of determining the value of λ determining the statistical characteristic of $p(x)$ comprises the steps of:

d-3-1) calculating an average of a random variable $|x|$ according to $E(|x|) = \int_{-\infty}^{\infty} |x| \cdot p(x) dx = \int_{-\infty}^{\infty} |x| \cdot \frac{\lambda}{2} \cdot e^{-\lambda|x|} dx = \frac{1}{\lambda}$; and

d-3-2) determining λ according to $\lambda = \frac{1}{E(|x|)}$.

15. The transcoding method of claim 14, wherein the step d-3-2) comprises the steps of:

d-3-2-1) approximating the value of $E(|x|)$ according to

$$E(|x|) \cong E(|y|) + E(|z|)_{\frac{\Delta}{2}}$$

where $E(|z|)_{\frac{\Delta}{2}} = \int_{-\frac{\Delta}{2}}^{\frac{\Delta}{2}} |z| \cdot p(z) dz$, and $p(z) = \frac{\lambda'}{2} \cdot e^{-\lambda'|z|} \quad where \ \lambda' = \frac{1}{E(|y|)}$;

d-3-2-2) calculating $E(|z|)_{\frac{\Delta}{2}}$ according to

$$E(|z|)_{\frac{\Delta}{2}} = 2 \cdot \int_0^{\frac{\lambda}{2}} z \cdot \frac{\lambda'}{2} \cdot e^{-\lambda'/z} dz = \frac{1}{\lambda'} - e^{-\lambda'\Delta/2}\left(\frac{1}{\lambda'} + \frac{\Delta}{2}\right)$$; and

d-3-2-3) estimating the value of λ according to

$$\lambda = \frac{1}{E(|x|)} \cong \frac{1}{E(|y|) + E(|z|)_{\frac{\Delta}{2}}} = \frac{\lambda'}{2 - e^{-\lambda'\Delta/2}(1 + \frac{\Delta}{2}\lambda')}.$$

16. A transcoding apparatus of performing conversion between compressed bitstreams having at least syntax elements and video elements corresponding to video data, the transcoding apparatus comprising:

a decoder for reconstructing syntax elements and video elements from a first bitstream complying with a first compression method;

an inverse quantizer for inverse-quantizing the video elements provided from the decoder according to the first compression method to reconstruct video data;

a quantizer for requantizing the video data according to a second compression method;

a syntax generator for mapping the syntax elements provided from the decoder to syntax elements complying with the second compression method; and

an encoder for encoding the requantized video data (video elements complying with the second compression method) provided from the quantizer and

09854385.052501

the syntax elements provided from the syntax generator according to the second compression method, thereby outputting a second bitstream.

17. The transcoding apparatus of claim 16, wherein the first compression method is a moving picture experts group (MPEG)-1 or MPEG-2 compression method, and the second compression method is a MPEG-4 compression method.

09854385.052501